REMARKS

This Amendment is responsive to the Office Action mailed on May 8, 2006. Claims 43, 73, and 93 are amended. Claim 99 is new. Claims 1-34 are cancelled. Claims 35-99 are pending. Claims 36-41, 79-92, and 98 are withdrawn.

As a preliminary matter, Applicant notes that the Examiner has not acknowledged the Information Disclosure Statement filed on September 29, 2003. The Examiner is respectfully requested to consider Applicant's September 29, 2003 Information Disclosure Statement and return an initialed copy of Applicant's form PTO-1449 with the next Official Communication.

The Examiner has indicated that claims 43-45, 73-75, and 93-97 contain allowable subject matter.

Claims 35, 46, 47, 63-71 and 76-78 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Petrzelka (US 5,222,915) in view of Wilson (US 4,336,868) and Satoh (US 5,264,259) and any one of Benkoczy (US 3,313,541), Kuch (US 5,160,562), Hanson (US 5,281,454) and Foissac (FR 2516859).

Claims 42 and 72 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Petrzelka (US 5,222,915) in view of Wilson (US 4,336,868) and Satoh (US 5,264,259) and any one of Benkoczy (US 3,313,541), Kuch (US 5,160,562), Hanson (US 5,281,454) and Foissac (FR 2516859), in further view of any one of Uchida (US 6,047,756), Pearce (5,261,980), or Aldrich (US 4,846,908).

Claims 48-57 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Petrzelka (US 5,222,915) in view of Wilson (US 4,336,868) and Satoh (US 5,264,259) and any one of Benkoczy (US 3,313,541), Kuch (US 5,160,562), Hanson (US 5,281,454) and Foissac (FR 2516859), in further view of any one of Stephens (US 2,467,999), Fairbairn (US 3,715,252), or French patent 2,525,962).

Claims 58-72 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Petrzelka (US 5,222,915) in view of Wilson (US 4,336,868) and Satoh (US 5,264,259) and any one of Benkoczy (US 3,313,541), Kuch (US 5,160,562), Hanson (US 5,281,454) and Foissac (FR 2516859), in further view of any one of Goldsworthy (US 4,125,423),Yu (US 5,435,868), Miller (US 2,731,067), or Zackrisson (US 5,261,991).

Applicant respectfully traverses these rejections in view of the amended claim and the following comments.

Discussion of Amended Claims

Claim 43, which contains allowable subject matter, is amended into independent form by the addition of the subject matter of claims 35 and 42.

Claim 73, which contains allowable subject matter, is amended into dependent form by the addition of a portion of the subject matter of claim 35 and the subject matter of claims 66 and 72.

Claim 93, which contains allowable subject matter, is amended into independent form by the addition of the subject matter of claims 35 and 66.

New claim 99 contains the allowable subject matter of claim 93.

Accordingly, claims 43-45, 73-75, 93-97, and 99 are in condition for immediate allowance.

Discussion of the Present Invention

One of the primary advantages of the present invention is that different layers may be provided in different portions of the hollow body in a single winding procedure by either supplying a single piece of flat material to the mandrel which has a specific contour or supplying multiple pieces of flat material to the mandrel at the same time.

This is in contrast to the winding of a single strand of material. When winding a single strand, it is possible to achieve a different thickness in different areas of the hollow body by moving the supply of the strand in an axial direction of the hollow body with varying velocity during the winding. Such a procedure cannot be used when winding a piece of flat material.

Typically, when winding a hollow body to obtain different layers in different areas, the layers are arranged on top of one another and the layers are supplied to the mandrel one at a time. However, it is not possible to wind such a hollow body in a single winding process, as after winding one piece of flat material on the mandrel the winding

procedure must be stopped so that the winding of the next piece of flat material may be started, resulting in separate winding procedures for each piece of flat material.

With Applicant's invention, a single winding procedure is used to obtain a hollow body with a rather complex structure of layers, which is not disclosed in any of the cited references.

Discussion of Petrzelka

Petrzelka discloses an energy absorbing element in the form of a hollow body having a different number of windings of reinforcing fiber in different areas of the hollow body so as to adjust the energy absorption (Col. 2, lines 60-66). The hollow body of Petrzelka cooperates with a fitting having a tearing or cutting element extending radially outward in relation to the axis of the hollow body so as to destroy one end of the hollow body in response to forces applied (Col. 2, lines 40-52).

The Examiner indicates at page 3 of the Office Action that the thickened areas of Petrezelka "can be formed by winding additional material (note col. 4, lines 14-22) and thus clearly varying number of layers of reinforcement are contemplated." Applicant respectfully submits that the Examiner has misinterpreted Petrzelka. Petrzelka discloses only the winding of fibers to obtain a varying wall thickness and does not disclose or suggest any method for winding flat material in a single winding procedure as claimed by Applicant. Petrezelka discloses that ". . . and the variable wall thickness, in this case, may be provided by additional circumferential windings." (Emphasis added) (Col. 2, lines 65-66; see also Col. 4, lines 20-22). As a result, Petrzelka does not disclose or remotely suggest a single winding procedure which produces a different number of layers of flat material in different areas of a hollow body as claimed by Applicant.

Further, Petrzelka discloses only that the hollow body end is destroyed (Col. 2, lines 36-52). Petrzelka does not disclose a hollow body in which cracks are formed in response to forces applied to an end of the hollow body and that the cracks travel parallel to the axis of the hollow body through different areas of the hollow body.

In addition, Petrzelka does not give any indication that a flat material should be used in the formation of an energy absorbing element or how such a hollow body could

be manufactured using flat material in a single winding procedure. Further, Petrzelka does not teach any mechanism for manufacturing a hollow body which generates cracks in response to applied forces which cracks in a defined manner as claimed by Applicant.

Petrzelka does not disclose or remotely suggest a process for the production of a hollow body formed from flat material in a single winding procedure which flat material is contoured to provide a different number of layers in different areas of the hollow body and which provides for the generation of cracks in a specific manner as claimed by Applicant.

Discussion of Wilson

Wilson discloses a hollow body used as an energy absorbing element and how such an energy absorbing element is destroyed.

However, Wilson does not indicate the formation of any cracks or indicate that cracks when being formed can continue through the different areas of the hollow body parallel to the axis as claimed by Applicant. Instead, Wilson shows that the hollow body is progressively crushed when subjected to force (See Figures 1a-1c).

Wilson discloses the winding of a fiber or a flat material to obtain the hollow body. However, Wilson does not disclose or remotely suggest a hollow body having a different number of layers in different areas thereof, as claimed by Applicant. Wilson is concerned only with the orientation of the fibers in the flat material and the influence of this orientation on energy absorbing characteristics.

Further, Wilson (like Petrzelka) does not disclose any process for the manufacture of a hollow body.

Applicant respectfully submits that the combination of Petrzelka and Wilson would not lead one skilled in the art to arrive at Applicant's invention, since neither Petrzelka nor Wilson disclose or remotely suggest a process for the production of a complex hollow body in a single winding process in which different layers of a flat material are obtained in different areas of the hollow body and in which the layers define a specific direction of crack generation as claimed by Applicant. The deficiencies of

Petrzelka and Wilson in this regard are not remedied by the disclosures of Satoh, Foissac, Benkoczy, Hanson, and Kuch, as discussed below.

Discussion of Satoh

Satoh discloses an energy absorbing hollow body structure. However, the disclosure of Satoh is far removed from the present invention.

As can be seen from the Figures of Satoh, the hollow body is uniform and, with the exception of chamfered ends, does not have a different number of layers in different areas thereof as claimed by Applicant. Further, the hollow body of Satoh is not formed by a winding procedure. Rather, the hollow body of Satoh is formed in a die by melting thermoplastic resin. There is no disclosure or suggestion in Sato of a winding procedure for a piece of flat material where the flat material is wound to obtain a hollow body with a different number of layers of flat material in different areas of the hollow body.

In addition, the energy absorbing system disclosed in Satoh is obtained by assembling a plurality of cylindrical hollow bodies and not a single cylindrical hollow body interacting with a number of different layers of flat material in different areas of the hollow body, as claimed by Applicant. Further, the energy absorbing system of Sato does not utilize a fitting having a surface extending radially outward in relation to the axis of the hollow body, as claimed by Applicant.

Further, Satoh also does not disclose any deformation or cracking of the hollow body end in response to applied forces. Satoh indicates only that the hollow body may be cut to such a length that no buckling occurs and bundled with other hollow bodies and attached to structure or moving body (i.e. a wall or a ship. etc.). Cutting the hollow body to a short length as in Satoh is not equivalent to Applicant's formation of a hollow body which has a different numbers of layers in different areas so that no buckling occurs and so that cracks are formed and generated parallel to the axis.

Discussion of Foissac

Foissac discloses a process for manufacturing a mast or pole for optimum stability, of the type for use with a windsurfing board.

Foissac does not teach any process for the production of energy absorbing elements. In particular, a mast or a pole due to its long length is particularly unsuited for use as an energy absorbing element which forms cracks rather than buckles in response to forces applied at its end. In fact, Foissac does not refer to any distortion of the mast.

Foissac does not disclose or remotely suggest Applicant's claimed process for the production of an energy absorbing structural element. In particular, Foissac does not disclose a hollow body having different layers of a flat material in different areas of the hollow body and in which the layers define a specific direction of crack generation as claimed by Applicant.

Discussion of Benkoczy

Benkoczy discloses a reinforced fiberglass shaft for a golf club. The shaft of Benkoczy is designed to provide flexibility while being resistant to torsion, bending and shear loads (Col. 1, lines 23-27). Fiberglass cloth is formed into a shaft with the warp fibers 35 extending generally parallel to the shaft axis and fill fibers 36 extending circumferentially to the axis (Col. 3, lines 22-26). The circumferentially extending fill fibers 36 are substantially fewer in number than the longitudinally extending warp fibers 35 to provide for maximum longitudinal thickness (Col. 3, lines 1-4, claim 1). The warp fibers and fill fibers are disposed in a plurality of layers, which plurality of layers vary in number along the length of the shaft, so that the wall thickness of the shaft varies along its length. The greatest thickness of the shaft is at its smaller end for maximum strength in the portion of the shaft adapted to support the club head (See, e.g., claim 1). In addition, a plurality of reinforcing glass fibers are disposed in the smaller end between the layers and at an angle of about 30 to 45 degrees to the longitudinal fibers to enable the shaft to resist torsional stresses at the end when the club head strikes a golf ball.

It is obvious from the disclosure of Benkoczy that the invention described therein is aimed at providing a golf club with maximum stability, in particular, maximum stability against torsional forces. The shaft of Benkoczy has a different thickness in different areas of the shaft due to the different torsional forces which will be experienced

in the different areas. In addition, Benkoczy uses an additional sheet 40 in a specific orientation to increase the strength of a lower end of the shaft.

Therefore, it can be appreciated that the entire disclosure of Benkoczy is directed at preventing any kind of disintegration of the unit of fibers and matrix material. Benkoczy does not disclose or remotely suggest that cracks can appear in such a material or what the orientation of such cracks would be if they were to appear.

Benkoczy does not disclose or remotely suggest a hollow body formed in a single winding procedure by supplying a single piece of flat material to the mandrel, which flat material is contoured to provide a number of different layers in different areas of the hollow body, as claimed by Applicant. In contrast, as can be seen from Figures 3, 4, and 12 of Benkoczy, numerous pieces of flat material are used in forming the hollow body.

Benkoczy further does not suggest a hollow body formed by supplying a plurality of pieces of flat material to a mandrel in a single winding procedure.

Benkoczy does not disclose or remotely suggest an end of the hollow body which cooperates with a fitting so as to generate cracks at the end of the hollow body, as claimed by Applicant. The end of the hollow body in Benkoczy is adapted for receiving a golf club head.

The shaft of the golf club of Benkoczy is a relatively lengthy and narrow hollow body which, if forces were applied in the direction of its longitudinal axis, would buckle somewhere between the ends of the shaft, rather than form cracks at one end which then propagate from that end of the shaft into the body of the shaft parallel to its axis. That the shaft of Benkoczy would buckle somewhere between its ends rather than form cracks at one is even more obvious once the varying thickness of the shaft are taken into consideration.

Further, the ratio of the length to diameter of the shaft of Benkoczy renders it completely useless as an energy absorbing device of the type contemplated by the present invention. Further, it is not certain from the disclosure of Benkoczy how the hollow bodied shaft would react when used as an energy absorber. The unpredictability of the reaction of the hollow body of Benkoczy is even more pronounced when the

reinforcement piece having fibers oriented at an angle of about 30 to 45 degrees with respect to the longitudinal axis is considered.

In contrast to the shaft of Benkoczy, the energy absorbing element of the present invention absorbs energy without folding in such a manner that the layers of the reinforcing flat material receive cracks at a first end which extend in a direction parallel to the axis and which continue through the different areas of the hollow body parallel to the axis.

Benkoczy does not disclose or suggest an energy absorbing element that absorbs energy by generating cracks in the reinforcing material extending from the first end which cooperates with the fitting parallel to the axis. As discussed above, the design of Benkoczy is directed at preventing cracks in a golf club shaft.

Further, Benkoczy does not disclose or remotely suggest that the hollow body is adapted to interact with a fitting having a surface which extends radially outward in relation to an axis of the hollow body, which fitting interacts with a first end of the hollow body to radially spread the first end of the hollow body, thereby producing cracks in the hollow body which cracks start at the first end of the hollow body and extend through the hollow body in a direction parallel to the axis.

Applicant respectfully submits that one skilled in the art would not look to golf club shaft technology for preventing cracks under stress to create an energy absorbing material that is designed to generate cracks in response to stress.

Discussion of Kuch

Kuch discloses a process for producing a hollow fiber-composite body. Kuch discloses the formation of a hollow body with lugs without any folds in a root region of the lugs (Col. 1, lines 35-38). This is accomplished by winding one layer over the other on a shaping core so as to obtain a plurality of layers of at least one prepeg web (Col. 1, lines 46-50). The lug is integrally formed by providing the web with a contour according to the contour of the respective lug (Col. 1, line 64 to Col. 2, line 5, Col. 2, lines 46-49).

Kuch does not disclose or suggest the formation of a hollow body in a single winding procedure with a single piece of flat material which has a different number of layers in different sections of a hollow body, as is present in the claimed invention.

It should be noted that the lug or flange portion of the hollow body in Kuch is not part of the hollow body itself. Further, the number of layers in the lug or flange portion in Kuch is identical to the number of layers in the hollow body.

Further, Kuch makes no mention of a specific structure which, when pressed into a fitting having a surface extending radially outwards in relation to the axis of the hollow body would lead to cracks formed at one end of the hollow body and extending parallel to the longitudinal axis of the hollow body. Kuch does not disclose or remotely suggest a hollow body adapted to interact with a fitting having a surface which extends radially outward in relation to an axis of the hollow body, which fitting interacts with a first end of the hollow body to radially spread the first end of the hollow body thereby producing cracks at the first end of the hollow body which propagate in a direction parallel to the axis.

Kuch does not disclose or remotely suggest a hollow body having a different number of layers in different areas as in the claimed invention. In addition, Kuch does not disclose or remotely suggest the claimed subject matter wherein energy is absorbed by generating cracks in the reinforcing material which cracks extend from a first end of the hollow body in a direction parallel to an axis of the hollow body.

Discussion of Hansen

Hanson is directed towards obtaining optimum bonds between dissimilar materials. In particular, Hanson teaches scarf joint bonds with superior load qualities (Abstract).

The disclosure of Hanson is not at all concerned with obtaining cracks or cracking of a hollow body made by windings of a woven fabric or tape impregnated with epoxy resin.

Figures 8 and 10 of Hansen disclose composite tubes. However, Hanson does not provide any disclosure regarding the energy absorption of the composite tube by crack formation so that the tube is destroyed. Rather, the disclosure of Hanson is only concerned with how to make a bonded joint between the tube and a fitting that has superior load qualities.

Hanson does not disclose or remotely suggest a process for the production of an energy absorbing structural element as claimed by Applicant.

In view of the new claims and the above discussion, it is clear that none of the cited references or any of the prior art of record, taken alone or in combination, discloses or remotely suggests the subject matter of the present claims. Only with hindsight gained impermissibly from Applicant's disclosure could one of ordinary skill in the art arrive at the claimed invention from the combination of the disclosures Petrzelka, Wilson, Satoh, Benkoczy, Kuch, Hanson and Foissac. Applicant respectfully submits that it would not have been obvious to one skilled in the art to combine the seven references as suggested by the Examiner.

Further, Applicant submits that even if one skilled in the art were to have combined the references cited by the Examiner, the result would not be equivalent to the claimed invention. In particular, Benkoczy (golf club shaft) and Foissac (windsurfing mast) are directed at hollow bodies which are designed not to crack or otherwise disintegrate during their intended use. Petrzelka refers to winding of fibers rather than flat material. Wilson shows a hollow body which is designed to be crushed, rather then form cracks in a defined manner when an end of the hollow body is subjected to forces. Satoh discloses a hollow body formed from a mold rather then a winding procedure. Kuch discloses the formation of a hollow body having lugs integrated therein. Hanson discloses only a method for making a scarf joint with superior load qualities.

Applicant respectfully submits that it would not be obvious to combine the cited references and arrive at Applicant's claimed process for the production of an energy absorbing structural element where a hollow body is formed in a single winding procedure from a single piece of flat material contoured such that the resulting hollow body has a different number of layers in different areas so that forces applied to an end of

the hollow body generate cracks in a defined manner which travel through the hollow body parallel to its axis.

Thus, Applicant respectfully submits that the present invention is not anticipated by and would not have been obvious to one skilled in the art at the time of invention.

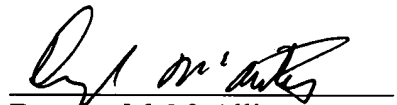
Further remarks regarding the asserted relationship between Applicant's claims and the prior art are not deemed necessary, in view of the above discussion and the amended claims. Applicant's silence as to any of the Examiner's comments is not indicative of Applicant's acquiescence to the stated grounds of rejection.

Withdrawal of the rejections under 35 U.S.C. § 103(a) is therefore respectfully requested.

Conclusion

The Examiner is respectfully requested to withdraw the election requirement and to pass this application on to an early issue. Should there be any remaining issues that need to be addressed in order to place this application into condition for allowance, the Examiner is invited to telephone Applicants' undersigned attorney.

Respectfully submitted,



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